MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

DTC5088 – ANALOG AND DIGITAL COMMUNICATION SYSTEMS

(Diploma in Electronic Engineering)

31 MAY 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **5** pages (**4** pages for questions and **1** page for appendix).
2. Answer **ALL** question.
3. Please write all your answers in the answer booklet provided.

QUESTION 1 [25 MARKS]

a) Give the definition of communication.

[2 marks]

b) Figure 1 shows the basic communication systems block diagram. Name and give definitions for i) and ii).

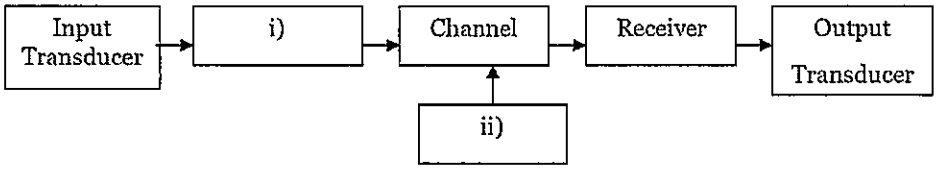

Figure 1

[6 marks]

c) State three types of signal operations.

[3 marks]

d) For the given signal $x(t)$ in Figure 2, find and sketch the output of $x(-3t+2)$.

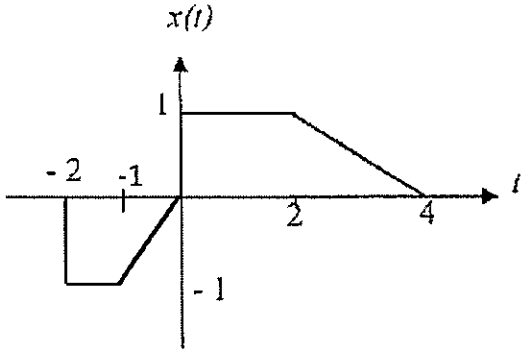

Figure 2

[5 marks]

e) Find all the Fourier Series coefficients for $x(t)=\begin{cases}0, & -\pi<t<0\\ 1, & 0<t\le\pi\end{cases}$.

[9 marks]

Continued...

QUESTION 2 [25 MARKS]

a) Explain modulation and draw the block diagram of modulation process.

[4 marks]

b) State all three types of amplitude modulation.

[3 marks]

c) Consider a frequency modulated signal with carrier frequency of $5\,MHz$ .Given the frequency of the modulating signal is $3\,kHz$ and the modulation index is 0.9. Sketch the frequency spectrum where $A_c = 5\,V$.

[10 marks]

d) In the amplitude modulated superheterodyne receiver, calculate the suitable frequency for the local oscillator to tune a $626\,kHz$ signal if the desired intermediate signal is $458\,kHz$. Consider for both high-side injection and low-side injection case.

[4 marks]

e) Figure 3 illustrates the general section in a superherodyne receiver. Name the section in the frequency modulated superheterodyne receiver that different from the one in amplitude modulated superheterodyne receiver. List the names of all the circuits within the section.

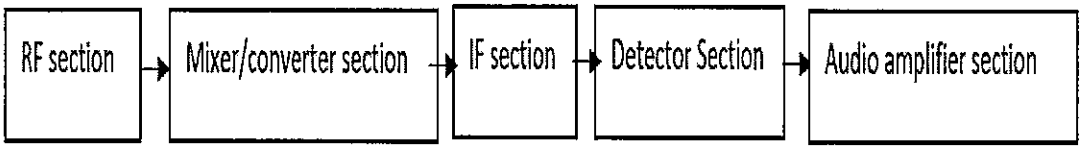

Figure 3

[4 marks]

Continued...

QUESTION 3 [25 MARKS]

a) Give the definition of analog to digital conversion.

[2 marks]

b) Sketch the sampled signal resulting from an input signal of $1\,kHz$ sine wave at $5\,kHz$ sampling rate with the pulse width of $\tau = 10\,\mu s$ by using the following techniques:

i) Flat top sampling.

ii) Natural sampling.

[6 marks]

c) An audio signal, which has maximum frequency of $25\,kHz$, is to be recorded on a digital compact disc using Pulse Code Modulation (PCM) technique. The audio signal is sampled at Nyquist rate, and quantized using 65,536 levels. Determine the number of bits required to encode a sample. Also, compute the bit rate of the PCM signal

[4 marks]

d) Explain the difference between baud rate and bit rate.

[2 marks]

e) Calculate the baud rate for the following:

i) 2000 *bps*, dibit

ii) 6000 *bps*, quadbit

[4 marks]

f) A constellation diagram has eight equally spaced points on a circle. It is found that the bit rate is 4800 *bps*. Determine the modulation scheme, baud rate and the angle between two points. Draw the constellation diagram.

[7 marks]

Continued...

QUESTION 4 [25 MARKS]

a) Show the difference between Manchester coding and Differential Manchester coding using a proper sketch.

[4 marks]

b) Sketch 1111111111 according to the following line coding scheme.

i) Unipolar

ii) NRZ-I

iii) AMI

iv) RZ

[8 marks]

c) Error correction can be handled in two ways. Explain both.

[4 marks]

d) A system uses longitudinal redundancy check (LRC). Find the parity unit for the following two data units. Assume odd parity.

1011100111, 0110101001

[4 marks]

e) Find the checksum for the following bit sequences. Assume a 16-bit segment size.

i) 1001001110010011

ii) 1001100001001101

[5 marks]

End of Page.

TABLE 4-1
Bessel functions of the first kind

		n or order of sidebands															
Modulation Index (m_f)	Carrier Frequency J_0	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8	J_9	J_{10}	J_{11}	J_{12}	J_{13}	J_{14}	J_{15}	J_{16}
0.00	1.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.25	0.98	0.12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.5	0.94	0.24	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.0	0.77	0.44	0.11	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.51	0.56	0.23	0.06	0.01	—	—	—	—	—	—	—	—	—	—	—	—
2.0	0.22	0.58	0.35	0.13	0.03	—	—	—	—	—	—	—	—	—	—	—	—
2.5	−0.05	0.50	0.45	0.22	0.07	0.02	—	—	—	—	—	—	—	—	—	—	—
3.0	−0.26	0.34	0.49	0.31	0.13	0.04	0.01	—	—	—	—	—	—	—	—	—	—
4.0	−0.40	−0.07	0.36	0.43	0.28	0.13	0.05	0.02	—	—	—	—	—	—	—	—	—
5.0	−0.18	−0.33	0.05	0.36	0.39	0.26	0.13	0.05	0.02	—	—	—	—	—	—	—	—
6.0	0.15	−0.28	−0.24	0.11	0.36	0.36	0.25	0.13	0.06	0.02	—	—	—	—	—	—	—
7.0	0.30	0.00	−0.30	−0.17	0.16	0.35	0.34	0.23	0.13	0.06	0.02	—	—	—	—	—	—
8.0	0.17	0.23	−0.11	−0.29	−0.10	0.19	0.34	0.32	0.22	0.13	0.06	0.03	—	—	—	—	—
9.0	−0.09	0.24	0.14	−0.18	−0.27	−0.06	0.20	0.33	0.30	0.21	0.12	0.06	0.03	0.01	—	—	—
10.0	−0.25	0.04	0.25	0.06	−0.22	−0.23	−0.01	0.22	0.31	0.29	0.20	0.12	0.06	0.03	0.01	—	—
12.0	0.05	−0.22	−0.08	0.20	0.18	−0.07	−0.24	−0.17	0.05	0.23	0.30	0.27	0.20	0.12	0.07	0.03	0.01
15.0	−0.01	0.21	0.04	−0.19	−0.12	0.13	0.21	0.03	−0.17	−0.22	−0.09	0.10	0.24	0.28	0.25	0.18	0.12

Source: E. Cambi, *Bessel Functions*, Dover Publications, Inc., New York, N.Y., 1948. Courtesy of the publisher.